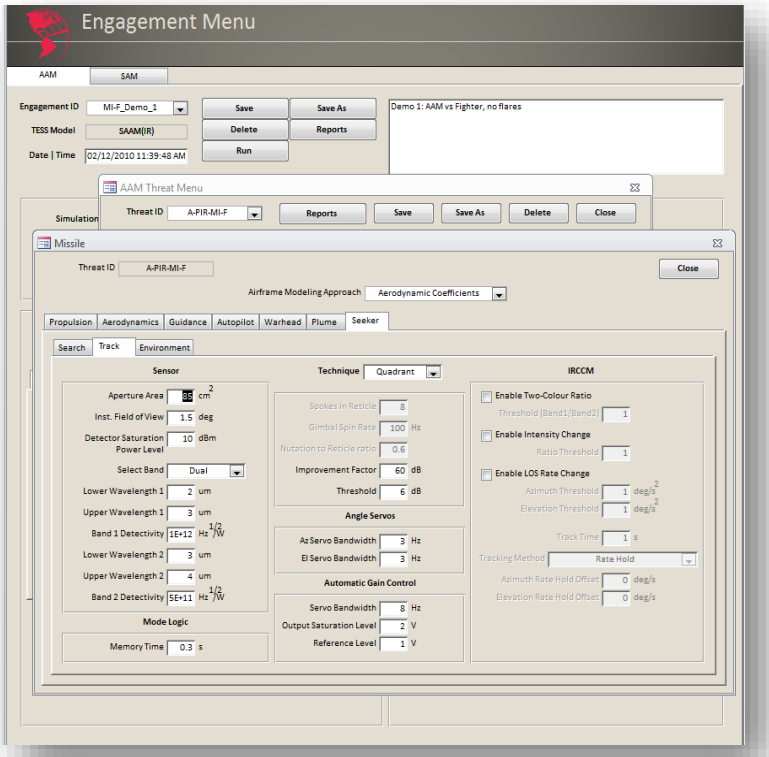
TACTICAL TECHNOLOGIES
a LEONARDO company

# Surface-to-Air and Air-to-Air Missile Passive Infrared Homing SAAM(IR)

**TACTICAL ENGAGEMENT SIMULATION SOFTWARE – TESS™**
**Modeling and simulation based tools for electronic attack and protection development**

## Overview

SAAM(IR) is a member of the Tactical Engagement Simulation Software (TESS) Air IR family of physics-based simulation products. SAAM(IR) models closed-loop engagements and interactions between a target platform (fixed or rotary wing) and up to two surface or air launched first, second or third generation IR-guided missiles. The maneuvering aircraft can deploy infrared flares, a towed IR decoy and/or activate its on-board infrared jammer (Omni-directional or DIRCM) to defend itself from incoming threats. TESS products simulate all phases of an engagement from missile launch, target acquisition and tracking, countermeasure deployment and end-game intercept. Measures of effectiveness such as miss distance, probability of kill and probability of survival are computed at end of the simulation. Like other TESS products, SAAM(IR) is built in the MATLAB/Simulink environment and with its available source code, users can review, inspect and modify any of the underlying models and algorithms. A front-end database allows the user to define and store data libraries of Targets, Countermeasures and Threats. A programmable batch runner is included for executing batch runs (Monte Carlo) of simulated tactical engagements.




*TESS Master Interface*

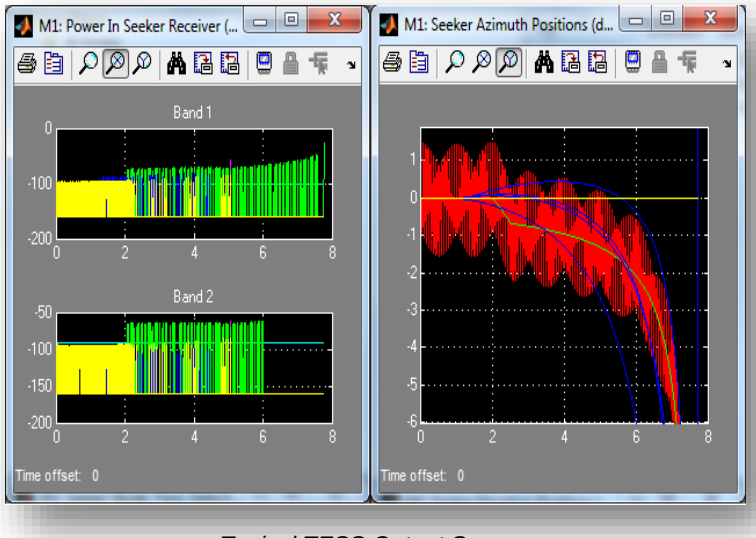
## Technical Description

### Target Modeling

- Configure the target aircraft with 1, 2 or 4 engines.
- Set the initial position, orientation and velocity.
- Specify the evasive maneuvers using acceleration commands and timings.
- Customize the infrared aircraft signature by entering spectral radiant intensity profiles as a function of aspect angle.
- Define the engine plume signatures using aspect dependent 3D lookup tables generated from third party signature prediction software or from own measurement data.

### IR Countermeasure Modeling

- Select flares, towed IR decoys and/or an IR jammer to protect the target aircraft.
- Customize the flare deployment timing sequence, orientations and ejection velocities.




*Typical TESS Output Scopes*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- Define the ballistic and propelled motion using aerodynamic parameters such drag, reference area, cartridge size, mass of flammable material, nozzle area and specific impulse.
- Operate the IR jammer in Omni-directional or DIRCM mode.
- Specify the MAWS accuracy, DIRCM tracker's detectivity, spectral bands, servo bandwidths, gimbal limits and search patterns.
- Characterize the DIRCM jammer (lamp or laser) by its power, beamwidth, turn-on times, duty cycles and modulation sweep rate.
- Employ the various IR countermeasure techniques individually or in combination against all search, acquisition and track modes of the missile seeker.

### Threat System Modeling

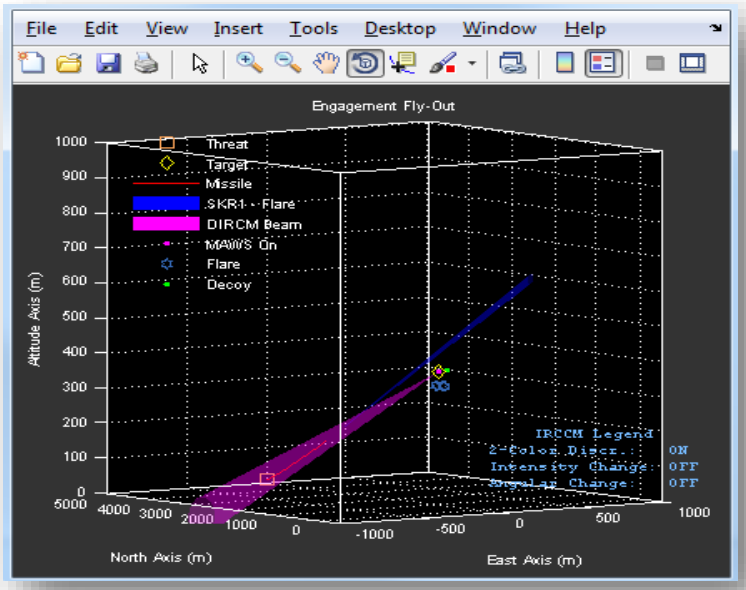
- Define each Threat Systems' initial launch position, maneuvers and timing.
- Model the missile body dynamics by transfer function representations or using aerodynamic tables generated from 3rd party software such as MISSILE DATCOM.
- Characterize other subsystems such as guidance, autopilot, propulsion, warhead and IR seeker type (Spinscan, Conscan, Rosette, Quadrant, PWM).
- Characterize the seekers with user-defined spectral operating bands, servo bandwidths, detectivity, field of view, noise equivalent power, and IRCCM such as two-color discrimination, intensity change and LOS rate change.

### Environment Modeling

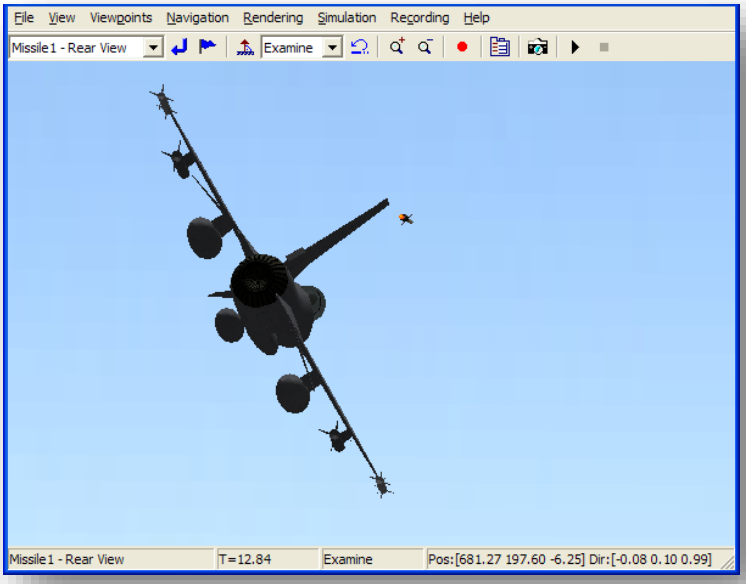
- Import MODTRAN data file to define spectral transmittance and solar/lunar irradiances for various environmental conditions

### Simulation Outputs

- View 3D trajectory plots and dozens of default scopes such as radiant intensity, seeker rates, seeker orientation, seeker modes and missile body acceleration.
- Record missile fly-outs for replay or further analysis.
- Compute several measures of effectiveness such as miss distance, probability of kill, probability of survival, seeker track/search percentage.
- Insert additional scopes to display signals of specific interest.




*TESS 3D Trajectory Plot*




*TESS Visualization Display*

## TESS™ APPLICATIONS

### Electronic Attack Development
Conduct research, development, testing and optimization of countermeasure techniques, deployment parameters and mode sequences in relation to particular threat characteristics in a wide range of tactical engagement geometries.

### Threat Weapon Analysis
Analyze and characterize the performance and susceptibilities of threat weapons and subsystems. Reverse engineer threat characterization parameters in relation to tracking, guidance and aerodynamic performance factors.

### Electronic Protection Development
Conduct research, development, and testing of electronic countermeasure-countermeasure techniques in relation to many types of countermeasures, both on-board and off-board, and a wide range of tactical engagement geometries.

### EW Operational Support
Support the programming of operational equipment by developing effective tactical programs and data loads in relation to specific threats, engagement geometries and tactics.

### Lab and Range Testing
Optimize and validate platform survivability in laboratory and field trial environments through trials planning supported by inexpensive but high fidelity software simulation trials. Carry out after-test results analysis to support trial documentation and report generation.